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Blueprints for resilience: MENA's DRR education through experts' eyes

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ABSTRACT

Background: All the existing frameworks of health-emergency disaster risk management have put great emphasis on the use of educational strategies to be used as a means of disaster risk reduction (DRR). Thus, this study was conducted to formulate experts' consensus on DRR educational strategies for Middle East/North Africa (MENA) countries.

Methods: A Delphi study on experts' opinions of DRR educational strategies was carried out through surveys in two consecutive rounds through a convenient sampling technique.

Results: A total of 60 responses were included in this study. Most of the participants were Saudi nationals, physicians (36.7% *vs.* 33.3% in round 1 and 2, respectively), and males (73.3%) with experience in disaster management (56.7%) of 5-10 years (60% *vs.* 53.3% in round 1 and 2, respectively). Around 80% of participants suggested that graduate health professional education should be through a problem-based learning approach (36.7%) (p-value = 0.007). Universal design for learning framework implementation required the provision of multiple means of engagement as a priority (p-value = 0.007). The best learning situation category was institution-based (60%) with the best approach for DRR learning as planned scheduled learning (p-value = 0.000). It was found that the best learning situations were lectures and small group sessions (73.3% each) (p-value = 0.165) that were delivered through a learning management system (90%) (p-value = 0.103), while the major stakeholders that should be involved in national DRR educational planning were Ministry of Health (90%) (p-value = 0.881).

Conclusion: Experts have a consensus opinion on DRR educational strategies in MENA countries.

Keywords: Opinion, MENA countries, disaster risk reduction, education, strategies, experts.

Introduction

In the year 2021 alone, a total of 432 disastrous events have occurred throughout the world acclaiming 10,492 deaths, affecting 101.8 million people, and resulting in approximately 252.1 billion US$ in economic losses [1].

The Middle East and North African countries (MENA) region consists of some of the most man-made and natural disaster-stricken countries in the world. This can be seen in countries like Iran, where between 1951 and 2001, a total of 421 flood events happened [2]. Also in Sudan, where in 2022, approximately 299,500 have been affected by seasonal rains and flash floods [3]. These MENA regions are also affected by severe water scarcity exacerbating chances of drought in this region [4]. Hence, centralized disaster mitigation and disaster risk reduction (DRR) strategies are required to reduce these effects [5-8].

Existing frameworks of the Hyogo Framework for Action, Sendai Framework, and WHO health-emergency disaster risk management framework (EDRM) put great emphasis on the use of educational strategies as a means for DRR for all stakeholders involved [9,10]. With the advancement of technology, the understanding of educational effectiveness, occurrences of disasters, and the experience with the world pandemic have exponentially increased literature on the existing and new DRR educational strategies.

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Different studies have been conducted to assess the available educational strategies for DRR, their effectiveness, and the effect of interventions on their effectiveness. Aghaei et al. [11] conducted a systematic review to assess and determine the strategies for education of DRR. It was a comprehensive systematic review assessing all the available educational strategies till 2015. The study followed preferred reporting items for systematic reviews and meta-analyses reporting guidelines. This study, however, does not cover educational strategies for DRR in biological hazards. Moreover, it does not explain the effectiveness and attitudes associated with the educational strategies [11].

A recent study by Chan et al. [12] explained the need for studies to highlight the DRR strategies for biological hazards, especially after facing the global COVID-19 pandemic.

Assessing these strategies from experts' opinions could help us formulate better DRR plans to curb the effects of the disasters. Thus this study aimed to conduct research to formulate experts' consensus on DRR educational strategies for MENA countries.

Materials and Methods

A Delphi study on experts' opinions on DRR educational strategies for MENA countries, was carried out from November 2022 to January 2023, through surveys that were delivered in two consecutive rounds.

Inclusion criteria were based on the definition of "expert" based on the following. A) Academic level: Master Degree-PhD\Professor-Professional Certificate and Experience. B) Specialty: Disaster Medicine-Disaster Management-Medical Education. Thus, any Disaster Medicine, Disaster Management, Health Professionals Educationalist, and Educational Expert who could be Professor, Associate professor, Ph.D. holder, Master's degree holder, Professional certificate holder, and had more than 10 years of professional experience were included in this study.

Health professions were focused in this study because it was believed that the curriculum of the health profession does not address the issue of DRR enough, especially in the MENA region countries and the COVID-19 pandemic is a good example of the importance in that context.

A convenient sampling technique was used, where European master of disaster medicine alumni, Kingdom of Saudi Arabia national experts, United Nations Office for Disaster Risk Reduction MENA office experts, WHO Regional Office for the Eastern Mediterranean office experts, Sudanese Disaster Management Colleges Experts, International experts' participation was considered.

The questionnaires were circulated to the included participants through social media platforms to make sure it is reachable to all the participants in the first round (Table 1).

Table 1. *Questions included in the first round of the survey.*

S. No.	Questions with their options
1	From your point of view, DRR education should be focused to which educational level(s)? A Primary education B Secondary education C Graduate - non medical education D Graduate - medical education E Post graduate education F All educational levels
2	From your point of view, what is the best educational approach (strategy) for DRR in MENA countries? A Student centeredness approach B PBL approach C Integration approach D Elective- driven curriculum approach E Systematic delivery approach
3	From your point of view, what is the second best educational approach (strategy) for DRR in MENA countries? A Student centeredness approach B PBL approach C Integration approach D Elective- driven curriculum approach E Systematic delivery approach
4	Considering the implementation of UDL framework in DRR context, the priority of principles should follow the following sequence for MENA countries? A Provide multiple means of engagement. (Priority #) B Provide multiple means of representation (Priority #) C Provide multiple means of action & expression (Priority #)
5	Following on the UDL frame work for DRR education, what are the priorities for approaches to provide multiple means of engagement A Provide options for recruiting interest (Priority #) B Provide options for sustaining effort & persistence (Priority #) C Provide options for self-regulation (Priority #)
6	Following on the UDL frame work for DRR education, what are the priorities approaches to provide multiple means of representation? A Provide options for perception (Priority #) B Provide options for language & symbols (Priority #) C Provide options for comprehension (Priority #)

(Continue)

S. No.	Questions with their options
7	Following on the UDL frame work for DRR education in MENA countries, what are the priorities for approaches to provide multiple means of action expression? A Provide options for physical action (Priority #) B Provide options for expression & communication (Priority #) C Provide options for executive functions (Priority #)
8	From your point of view, what is the best learning situation's category for DRR education in MENA countries? A Institution - based B Community - based
9	From your point of view, what is the best approach for DRR learning situations in MENA countries? A Planned - scheduled learning B Independent (Flexible) learning C Peer - assisted learning D Extra-curricular learning
10	From your point of view, select the best learning situations for DRR education in MENA countries (Multiple selection enabled) A Lectures B Small group sessions C Tutorials D Seminars E Assignments F Campus - based practical sessions G Facility - based practical sessions H Field - based practical sessions I Field visits J Others (Please specify)
11	From your point of view, what type of technologies that can be used to deliver DRR educational content in MENA countries (Multiple selection enabled) A Learning management systems B Mobile applications C Television (TV) D Radio E Video conferencing & streaming F Others (Please specify)
12	From your point of view, who are the stakeholders that should involved in national DRR educational planning in MENA countries? (Multiple selection enabled) A Ministry of education B Ministry of Health C Civil defence D Red cross\Crescent E Legislative\Regulatory health professions education bodies F Others (Please specify)

It was noticed that some of the first round participants did not participate in the second round, hence, additional experts were invited to participate in the second round. Google analytics were performed to assess the demographics of the participants and to assess the consensus of the experts upon all agreed points in round 1. The experts through separate surveys (Google form) provided the data in two rounds. The data were stored and managed using Microsoft Excel 2016 and SPSS version 26. Descriptive statistics was used to represent the results. The categorical data were represented in frequency (percentages) while the continuous data were represented as mean ± standard deviation or median (interquartile range). The test of significance was analyzed through paired sample *T*-test and ANOVA. A *p*-value of <0.05 was considered as statistically significant.

Results

A total of 60 responses were included in this study with 30 responses in each round. Most of the participants were Saudi nationals in both rounds (84% each). Furthermore, most of the participants were males (73.3%) with experience in disaster management (56.7%) of 5-10 years (60% *vs.* 53.3% in round 1 and round 2, respectively). The major specialty was physicians (36.7% *vs.* 33.3% in round 1 and round 2, respectively) having current affiliation with governmental organizations (86.7% *vs.* 90% in round 1 and round 2, respectively) (Table 2).

When participants were inquired about the educational level on which DRR education should focus, the majority (80%) suggested graduate health professional education, and 20% voted for post-graduate health professional education.

Likewise, when the participant's point of view was assessed for the best learning situation for DRR education in MENA countries, it was found that 60% reported institution-based learning, while 40% reported community-based learning. The following approaches include planned scheduled learning (53.3%) followed by peer-assisted learning (20%), independent (flexible) learning, and extra-curricular learning (13.3% each).

Moreover, problem-based learning (PBL) (36.7%) was considered as the best educational approach (strategy) for DRR in MENA countries followed by the integration approach (31.7%) (Figure 1).

Furthermore, considering the implementation of the universal design for learning (UDL) framework in

Table 2. *Demographics of the participants in both round 1 and round 2.*

Variables		Round 1 *N* (%)	Round 2 *N* (%)
Nationality	Saudi Arabia	25 (84)	25 (84)
	America	2 (7)	1 (3)
	Egypt	1 (3)	1 (3)
	Sudan	1 (3)	1 (3)
	Italy	0 (0)	1 (3)
	Canada	1 (3)	0 (0)
	Australia	0 (0)	1 (3)
Gender	Males	22 (73.3)	22 (73.3)
	Females	8 (26.7)	8 (26.7)
Experience area	Disaster medicine	7 (23.3)	7 (23.3)
	Disaster management	17 (56.7)	17 (56.7)
	Medical education	6 (20)	6 (20)
Specialty	Physician	11 (36.7)	10 (33.3)
	Nurse	8 (26.7)	9 (30)
	Paramedic	2 (6.7)	7 (23.3)
	Public health specialist	9 (30)	4 (13.3)
Current affiliation	Government	26 (86.7)	27 (90)
	Private	1 (3.3)	0 (0)
	NGOs	3 (10)	3 (10)
Years of experience in disaster field or medical education	5-10 years	18 (60)	16 (53.3)
	10-15 years	6 (20)	9 (30)
	15-20 years	2 (6.7)	5 (16.7)
	More than 20 years	4 (13.3)	0 (0)

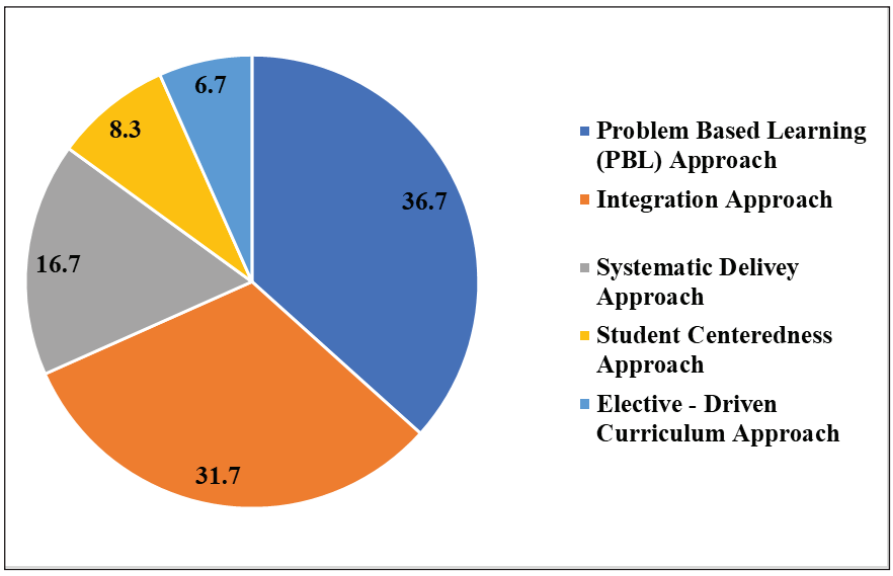

Figure 1. *The best educational approach (strategy) for DRR in MENA countries, considering the implementation of UDL framework in the DRR context, as per the participants in round 1 (n = 30).*

the DRR context, the priority principle was found to be the provision of multiple means of engagement through the provision of options for recruiting interests. It was followed by the provision of multiple means of representation through provisions of options for perception. The last priority was the provision of multiple means of actions and expressions through the provision of options for physical actions.

It was found that the best learning situations for DRR education were lectures and small group sessions (73.3% each) (Figure 2).

The types of technologies that could majorly be used to deliver DRR educational content were learning management systems (90%), video conferencing and streaming (73.3%), and mobile applications (70%) (Figure 3).

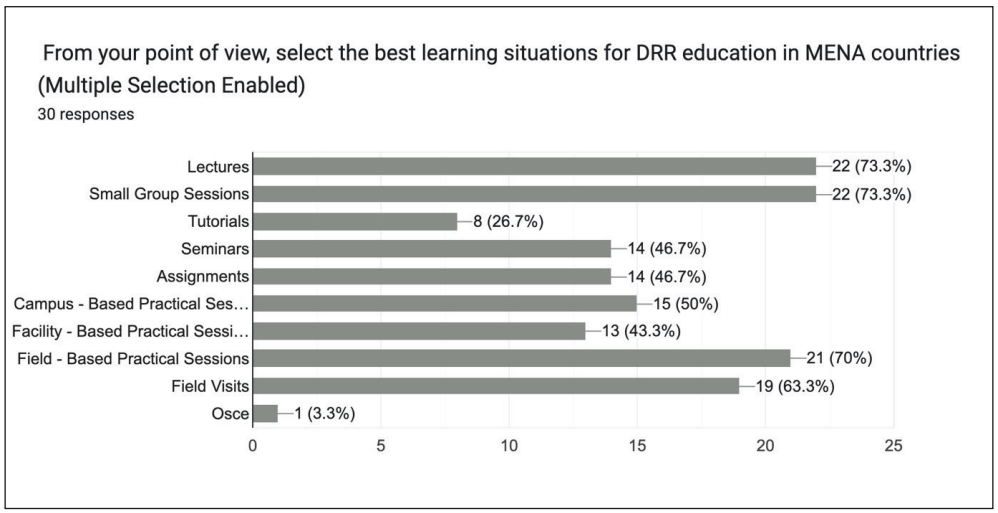

Figure 2. *Round 1 participants' point of view for the best learning situations for DRR education in MENA countries (multiple selections enabled-30 responses).*

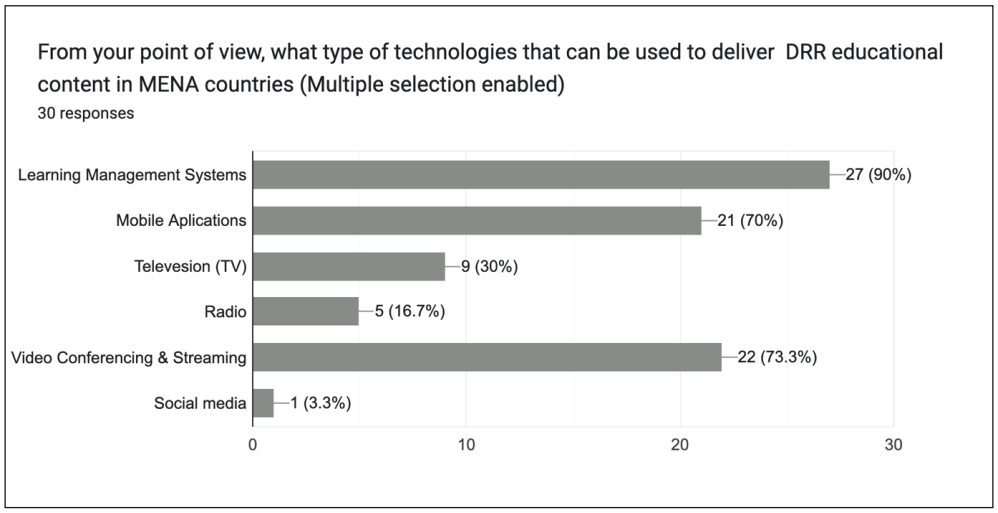

Figure 3. *Round 1 participants' point of view for the best type of technologies that could be used to deliver DRR educational content in MENA countries (multiple selections enabled-30 responses).*

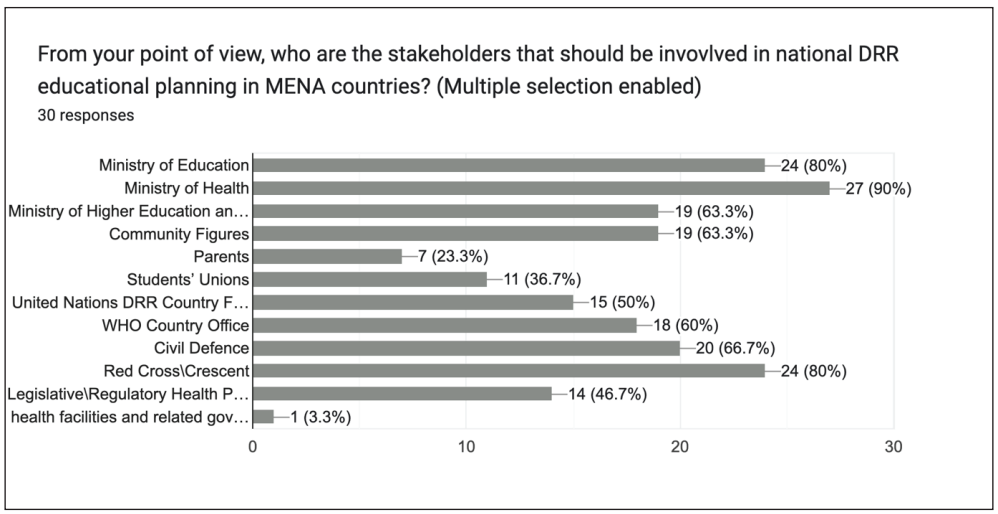

Figure 4. *Round 1 participants' point of view for the stakeholders that should be involved in national DRR educational planning in MENA countries (multiple selections enabled-30 responses).*

While the major stakeholders that should be involved in national DRR educational planning in MENA countries were the Ministry of Health (90%), Ministry of Education, and Red Cross (80% each) (Figure 4).

Almost 60% of participants in round 2 had worked or had been on a mission in any of the MENA countries. Furthermore, when participants in round 2 were inquired about their perception of the answers reported in survey 1, it was found that the priorities sequence of DRR education for health professionals based on its importance to each specialty was not accepted by exactly half of the experts (50%) in round 2 significantly (p-value = 0.000). Furthermore, the first and second best educational approach (strategy) for DRR in MENA Countries was the PBL and Integration Approach was agreed upon by 83.3% and 90% of experts in round 2 significantly (p-value = 0.007 and 0.000, respectively). Moreover, considering the implementation of the

Table 3. *Round 2 participants' perception about the answers reported in survey 1 (n = 30).*

Perception of participants	*N*	%	*p*-value
"From your point of view, DRR education should be focused to which educational level(s)", the most selected answer is (Graduate health professionals), do you agree with the majority in the answer?			
Yes	25	83.3	0.204
No	3	10	
Neutral	2	6.7	
"From your point of view, what are the priorities sequence of DRR education for health professionals based on its importance to each specialty?". The priorities come as follows: Priority 1 (Physicians), Priority 2 (Public Health Specialists), Priority 3 (Medical Laboratory Specialists), Priority 4 (Pharmacists), Priority 5 (Paramedics), Priority 6 (Nurses), Priority 7 (Radiological Sciences Specialists), Priority 8 (Dentists), do you agree with this priorities sequence?			
Yes	9	30	**0.000**
No	15	50	
Neutral	6	20	
"From your point of view, what is the first best educational approach (strategy) for DRR in MENA countries" the most selected answer is (PBL), do you agree with the majority in the answer?			
Yes	25	83.3	**0.007**
No	1	3.4	
Neutral	4	13.3	
"From your point of view, what is the best second educational approach (strategy) for DRR in MENA Countries" the most selected answer is (Integration approach), do you agree with the majority in the answer?			
Yes	27	90	**0.000**
No	0	0	
Neutral	3	10	
"Considering the implementation of UDL framework in DRR context, the priority of principles should follow the following sequence for MENA countries", The priorities came as follows: Priority 1 (Provide multiple means of engagement), Priority 2 (Provide multiple means of representation), Priority 3 (Provide multiple means of action & expression), do you agree with this priorities sequence?			
Yes	24	80	**0.007**
No	2	6.7	
Neutral	4	13.3	
"Following on the UDL framework for DRR education, what are the priorities for approaches to provide multiple means of engagement", The priorities came as follows: Priority 1 (Provide option for self-regulation), Priority 2 (Provide options for sustaining effort & persistence), Priority 3 (Provide option for recruiting interest), do you agree with this priorities sequence?			
Yes	23	76.7	**0.005**
No	1	3.3	
Neutral	6	20	
"Following on the UDL framework for DRR education, what are the priorities approaches to provide multiple means of representation?", the priorities came as follows: priority 1 (Provide options for language & symbols), Priority 2 (Provide options for comprehension), Priority 3 (Provide options for perceptions), do you agree with this priorities sequence?			
Yes	24	80	**0.004**
No	0	0	
Neutral	6	20	
"Following on the UDL framework for DRR education in MENA countries, what are the priorities for approaches to provide multiple means of action & expression?", The priorities came as follows: priority 1 (Provide options for physical action), Priority 2 (Provide options for expression & communications), Priority 3 (Provide options for executive functions), do you agree with this priorities sequence?			
Yes	23	76.7	**0.016**
No	1	3.3	
Neutral	6	20	

(Continue)

Perception of participants	N	%	p-value
"From your point of view, what is the best learning situation's category for DRR education in MENA countries? The most selected answer is (Institution - based), do you agree with the majority in the selected answer?			
Yes	24	80	0.354
No	4	13.3	
Neutral	2	6.7	
"From your point of view, what is the best approach to be implemented for DRR learning situations in MENA countries?" The most selected answer is (Planned - scheduled learning), do you agree with the majority in the selected answer?			
Yes	26	86.7	**0.000**
No	0	0	
Neutral	4	13.3	
"From your point of view, select the best learning situation for DRR education in MENA countries ", the most selected answers is (Lectures and small group sessions), do you agree with the majority in the selected answers?			
Yes	21	70	0.165
No	3	10	
Neutral	6	20	
"From your point of view, what type of technologies that can be used to deliver DRR educational content in MENA countries" the most selected answer is (Learning management systems), do you agree with the majority in the selected answer?			
Yes	24	80	0.103
No	1	3.3	
Neutral	5	16.7	
"From your point of view, who are the stakeholders that should be involved in national DRR educational planning in MENA countries?", more than 70% from the experts selected (Ministry of Health, Red Cross/Crescent, Ministry of Education) do you agree with the majority in the selected answers?			
Yes	27	90	0.881
No	1	3.3	
Neutral	2	6.7	

Bold values indicate significate *p*-value.

UDL framework in the DRR context, the priority of principles for MENA countries was agreed upon by the experts at a significant level of 0.007. Also, the best approach to be implemented for DRR learning situations in MENA countries was agreed as Planned-Scheduled Learning by 86.7% of experts in round 2 (p-value = 0.000) (Table 3).

Discussion

Keeping the current situations, the need for more efficient utilization, management, and coordination of resources, and the upcoming public health risks in mind, there is an emerging need to consolidate practice and contemporary approaches through the paradigm or concept of "disaster risk management and health emergency." The DRR educational strategies should be used as a base for policies and programs to reduce the consequences of disasters and emergencies and health risks. Emphasis is laid on the management of health risks in disasters or emergencies, and not sole responses to crisis or unfortunate events, and on building the resilience of countries and communities in the continuum of health EDRM. Thus, this study aimed to analyze the most appropriate DRR educational strategies and situations for MENA countries from an expert's point of view and also to outline the most appropriate DRR educational tools for MENA countries and the national relevant stakeholders for DRR educational planning in MENA countries.

The Arab region has developed strategies, policies, and plans for the reduction of national disaster risk. Out of 22 Arab countries, only seven have developed their DRR strategies at the national DRR level. In addition, the making cities resilient campaign was joined by almost 300 Arab cities and Municipalities. Many Arab countries have started reporting their disaster losses thereby leading towards informed risk analysis [13].

For instance, a systemic review was conducted to explore the role of DRR education [14]. It was reported that there is an active role of Non Governmental Organizations (NGOs) [15,16], stakeholders [17], and community participation [18,19] in making strategies and public policies for strengthening DRR [20,21]. This is in accordance with the current study results. This emphasizes the community-based DRR techniques to make resilient communities and also to reduce the vulnerabilities and impact of disasters through education [22]. However, this contradicts with the current study results where experts agreed to have institution-based DRR education in MENA countries but at non-significant levels.

Another study conducted by Kitagwa in 2021, concluded that DRR activities should provide engagement along with learning perspectives so that people can conceptualize, prepare themselves, and make themselves resilient, thereby assisting the process of DRR management [23]. This is in accordance with the current study results where experts agreed significantly to provide multiple means of engagement as the priority of principles for MENA countries considering the implementation of the UDL framework in the DRR context.

Studies have also emphasized on the selection of DRR educational strategies as they are significantly linked

to promoting the knowledge of DRR among the public and enhancing their abilities for DRR. Hence, multiple representations of linguistics are considered an important aspect in this regard [24]. This was consistent with the current study findings where the provision of options for language and symbols as a priority for multiple means of representation was significantly agreed upon by the experts for MENA countries.

According to the policy briefs, recovery and resilience extend their need to all sectors including education, finance, housing, psychosocial, public safety, and health. For recovery in the health sector, educating the public about the importance of accurate public health information in various modes of communication and empowering youth to make evidence-based decisions about their health, while also taking a proactive role in avoidance and mitigation is emphasized [25].

The study followed the Delphi method for obtaining a consensus on DRR educational strategies in MENA countries, where the scarcity of regional publications in this regard remains a challenge. However, sample size remains a considerable limitation of this particular study.

Conclusion

Experts have a consensus opinion on DRR Educational strategies in MENA countries. Where, UDL framework implementation required the provision of multiple means of engagement, the best learning situation was institution based, with the best approach for DRR learning being planned scheduled learning. It was found that the best learning situations were lectures and small group sessions that were delivered through the learning management system. Furthermore, the major stakeholder that should be involved in national DRR educational planning is the Ministry of Health.

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Conflict of interest
The authors declare no conflicts of interest in the publication of this study.

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Consent to participate
Informed consent was obtained from all participants.

Ethical approval
This study protocol was reviewed and approved by the Central Institutional Review Board at the Ministry of Health, IRB log number: 22-56M, dated: 21-11-2022.

Author contributions
All authors equally contributed to designing the study, analyzing the data, preparing the manuscript,
and also in approval of the final manuscript.

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References

1. CRED. Disasters in numbers. CRED; 2021. Available from: https://cred.be/sites/default/files/2021_EMDAT_report.pdf
2. Yavarian J, Shafiei-Jandaghi NZ, Mokhtari-Azad T. Possible viral infections in flood disasters: a review considering 2019 spring floods in Iran. Iran J Microbiol. 2019;11(2):85–9.
3. Faour-Klingbeil D, Todd ECD. The impact of climate change on raw and untreated wastewater use for agriculture, especially in Arid regions: a review. Foodborne Pathog Dis. 2018;15(2):61–72.
4. Relief Web. Sudan: weekly floods round-up, no. 07. 2022 [cited 2022 Oct 6]. Available from: https://reliefweb.int/report/sudan/sudan-weekly-floods-round-no-07-19-september-2022
5. Apronti PT, Osamu S, Otsuki K, Kranjac-Berisavljevic GJS. Education for disaster risk reduction (DRR): linking theory with practice in Ghana's basic schools. Sustainability. 2015;7(7):9160–86.
6. Ardalan A, Masoumi G, Gouya MM, Ghafari M, Miadfar J, Sarvar M, et al. Disaster health management: Iran's progress and challenges. Iran J Publ Health. 2009;38:93–7.
7. Zimmerman C, Kiss L, Hossain M. Migration and health: a framework for 21st century policymaking. PLoS Med. 2011;8(5):e1001034.
8. Keim ME. Building human resilience: the role of public health preparedness and response as an adaptation to climate change. Am J Prev Med. 2008;35(5):508–16.
9. The next era of disaster risk reduction. Lancet. 2015;385(9982):2016.
10. World Health Organization. Health emergency and disaster risk management framework. Geneva, Switzerland: World Health Organization; 2019. Available from: https://apps.who.int/iris/handle/10665/326106
11. Aghaei N, Seyedin H, Sanaeinasab H. Strategies for disaster risk reduction education: a systematic review. J Educ Health Promot. 2018;7:98.
12. Chan EYY, Dubois C, Fong AHY, Shaw R, Chatterjee R, Dabral A, et al. Reflection of challenges and opportunities within the COVID-19 pandemic to include biological hazards into DRR planning. Int J Environ Res Public Health. 2021;18(4):1614.
13. Platform on Disaster Risk Reduction. Prioritized action plan 2018-2020 of the Arab strategy for disaster risk reduction 2030 to implement the Sendai framework for disaster risk reduction 2015-2030. 2018. Available from: https://www.preventionweb.net/files/57759_draftarabplanofpriortyaction2018202.pdf
14. Cabello VM, Véliz KD, Moncada-Arce AM, Irarrázaval García-Huidobro M, Juillerat F. Disaster risk reduction education: tensions and connections with sustainable development goals. Sustainability. 2021;13(19):10933.

15. Gampell A, Gaillard JC, Parsons M, De LL. Fostering student participation in disaster risk reduction through disaster video games. Aust J Emerg Manag. 2020;35(2):43–50.
16. Selby D, Kagawa F, Oberman R. Along the cays and bays: climate change learning in a small Island developing state. Policy & practice: a development education review. Dev Educ Clim Change. 2020;30:31–56.
17. Carone MT, Marincioni F. From tale to reality: geographical differences in children's flood-risk perception. Area. 2020;52(1):116–25.
18. Piangiamore GL, Musacchio G. Participatory approach to natural hazard education for hydrological risk reduction. In: Sassa K, Mikoš M, Yin Y, editors. Advancing culture of living with landslides: volume 1 ISDR-ICL Sendai partnerships 2015-2025. Springer Int Publish; 2017. pp 555–61.
19. Amri A, Bird DK, Ronan K, Haynes K, Towers B. Disaster risk reduction education in Indonesia: challenges and recommendations for scaling up. Nat Hazards Earth Syst Sci. 2017;17(4):595–612.
20. Kelman I, Mercer J, Gaillard JC, editors. The Routledge handbook of disaster risk reduction including climate change adaptation. Londres, UK: Routledge; 2017.
21. Nche GC, Achunike HC, Okoli AB. From climate change victims to climate change actors: the role of eco-parenting in building mitigation and adaptation capacities in children. J Environ Educ. 2019;50(2):131–44.
22. Faustini P. The challenges of climate change: children on the front line. New York, NY: UNICEF Publications; 2014.
23. Kitagawa K. Disaster risk reduction activities as learning. Nat Hazards. 2021;105(3):3099–118.
24. Liu R, Fei L, Mi J. An evidential MULTIMOORA approach to assessing disaster risk reduction education strategies under a heterogeneous linguistic environment. Int J Disaster Risk Reduct. 2022;78:103114.
25. Benadusi M. Pedagogies of the unknown: unpacking 'culture'in disaster risk reduction education. J Contingencies Crisis Manag. 2014;22(3):174–83.